REMARKS

Status of the Application

Claims 52-91 are currently pending in the application for consideration by the Examiner.

New Claims 52-91 are Fully Supported by the Original Disclosure

The above amendments do not add new matter to the application and are fully supported by the specification, wherein such support may be found, *inter alia*, at ¶¶ 62, 71, 77-86 and Figs. 6-7E.

Section 103 Rejections

The new independent claims of the present application disclose an electrochemical sensor for measuring an analyte comprising a first working electrode that includes a first set of redox species sensitive to the analyte, a second working electrode comprising a second set of redox species insensitive to the analyte, a counter electrode, a reference electrode and means for detecting relative shifts between oxidation and reduction peaks produced by the first and the second redox species.

In the Final Office Action, previous independent claim one was rejected under 35 U.S.C. §103(a) as being unpatentable over United States Patent No. 5,676,820 to Wang *et al.* ("Wang") in view of United States Patent No. 5,223,117 to Wrighton *et al.* ("Wrighton").

The Wang reference teaches electrochemically detecting metal and organic contaminants in water by measuring changes in size of a peak response produced either by the electrochemical stripping of the contaminant metal from the water or a biocatalytic reaction between an enzyme electrode and the organic contaminant in the water. (See Wang at Col. 4, l.35 to Col. 5, l.27 and Col. 9, l.58 to Col. 10, l.9). The Wang reference does not teach the feature of the new independent claims of the present application, as presented herein, of applying a square wave potential sweep between a reference electrode and a working electrode that comprises a first redox species. In fact, the Wang reference provides absolutely no teaching or suggestion regarding the operation or use of a working electrode comprising a

redox species in an electrochemical sensor. To the contrary, the Wang reference only provides teaching and suggestion regarding electrochemical sensors based on electrochemical stripping or enzyme electrodes.

In electrochemical stripping the metal in the water is stripped out from the water and deposited on a counter electrode. Electrochemistry with an enzyme electrode involves a biocatalytic reaction between the enzyme on an electrode and a reagent to be detected. As noted above, these processes provide no teaching or suggestion regarding use/operation of a redox species on a working electrode of an electrochemical sensor. Furthermore, the stripping and biocatalytic reaction techniques described in Wang are different to the techniques of the independent claims of the present invention, as provided in new claims 52 and 90, in that they are consumptive techniques (metal is deposited on the counter electrode in the stripping technique and must be removed and reagents are consumed in the biocatalytic reactions), whereas the redox based system of the present application provides a reversible, non-consumptive electrochemical technique.

Furthermore, the methods described in Wang are amperometric – wherein the concentration of the metal and organic contaminants in the water is determined from the height of the peak current produced by the metal contaminant being stripped from the water or the height of the peak current produced by the biocatalytic reaction of the organic contaminant with the enzyme electrode. (*See* Wang at Col. 6, ll. 32 through Col. 7, ll. 11 and Col. 10, ll. 3-24. This amperometric determination of concentration relies upon the peak of the current produced in the sensor increasing with the amount of the contaminant to be measured. *See* Wang at Col. 6, ll. 65-67) ("The well defined peaks increase linearly with metal concentration over the entire range"). Consequently, Wang provides no teaching or suggestion with respect to the feature of the new independent claims of using the relative separation between the potentials of peak currents (the separation of peaks) of different redox species to measure an analyte. Such, a relative measurement of changes in the separation of the potentials corresponding to peak currents is a voltammetric rather than an amperometric technique.

As discussed above, the Wang reference provides no teaching or suggestion regarding use of redox species on a working electrode to detect an analyte and in fact teaches a totally different electrochemical technology involving metallic stripping and biocatalytic reactions where compounds are consumed/stripped and measurements are made based on amperometric (peak height) measurements, rather than the peak separation feature of the new independent claims. As such, Wang provides no teaching regarding the use of redox species on a working electrode in an electrochemical sensor and because the electrochemical techniques it does describe are unrelated to electrochemistry using redox species on a working electrode, it provides absolutely no suggestion regarding an electrochemical sensor comprising two working electrodes that include different redox species – one redox species sensitive to the analyte and one redox species insensitive to the analyte. Moreover, because the Wang reference is wholly unrelated to electrochemical sensors utilizing redox species on the working electrode and in fact describes different and inapposite technology, no motivation to combine exists with regard to it and the Wrighton reference, which reference does describe the use of redox species in a microelectrochemical sensor.

Like Wang, the Wrighton reference does not teach or suggest the feature of the new independent claims of applying a square wave potential sweep between a working electrode, comprising a first redox species, and a reference electrode. To the contrary, the Wrighton reference expressly teaches a two terminal microsensor that does not require and does not use a separate, independent reference electrode. (*See* Wrighton at Col. 1, ll. 10-12). Consequently, neither Wrighton nor Wang, whether considered individually or in combination, teach all of the features of the new independent claims of the present application.

Moreover, not only does the Wrighton reference fail to teach or describe the feature of the present independent claims of applying a square wave potential sweep between a working electrode comprising a first redox species and a reference electrode, the Wrighton reference actually teaches away from such a feature as it specifically teaches a two terminal, microelectrode system in which the advantage of the system is that a separate reference electrode is not used. Furthermore, the Wrighton reference states that the described operation without a reference electrode is the advantage of the system and is the feature that distinguishes

the system from other microelectrochemical sensors. (*See* Wrighton Col. 1, ll.65-68 and Col. 3, ll.33-39).

Because Wrighton teaches a two electrode microelectrochemical sensor and expressly teaches away from the use of a separate reference electrode, no motivation exists for a person of skill in the art to combine the teaching of Wrighton with a reference like Wang that describes the use of a reference electrode. Moreover, because Wrighton only discloses the use of a two terminal linear voltage sweep between a working and counter electrode and how such a sweep is used in the two terminal device, the Wrighton provides absolutely no teaching or suggestion regarding the feature of the present independent claims of applying a square wave potential sweep between a working electrode comprising a first redox species and a reference electrode; including whether/how a redox based sensor would function with a separate reference electrode, how the sensor should be configured with a reference electrode, the effect of the reference electrode, advantages/disadvantages of the reference electrode *etc*.

In the present application, the use of a separate referenced electrode with a counter electrode, a first working electrode comprising a sensitive redox species and a second working electrode comprising an insensitive working electrode produces a synergetic effect – namely, the separate reference electrode provides a baseline reference for the electrochemical sensor, the combination of the reference electrode and the second working electrode comprising the insensitive redox species allows for drift in the sensor to be accounted for and the overall combination of the four electrode electrochemical sensor, including the reference electrode, allows for use of larger sizes of the first working electrode (other than microelectrode dimensions), which prevents fouling issues associated with a microelectrode and removes the requirement of the counter electrode having a surface area of the order of a hundred times larger than the first working electrode. This synergy of the electrochemical system claimed in the present application is not taught or suggested by Wrighton, which reference expressly describes a system that does not use a reference electrode and teaches the advantages of not using a reference electrode and thereby does not recognize or suggest the synergy of the present electrochemical sensor that includes the feature of an independent reference electrode. Similarly, the Wang reference with its teaching regarding metal stripping and biocatalytic

reactions provides no teaching or suggestion regarding the synergistic effect provided by using a reference electrode in a redox based electrochemical sensor.

Applicants also note that both Wang and Wrighton describe microelectrochemical sensor systems that use a microelectrode, whereas the electrochemical sensor of the present application is not limited to microelectrochemistry. Finally, Applicants respectfully submit that the new independent claims of the present application include a combination of features – two working electrodes (one working electrode comprising a redox species sensitive to an analyte and the other working electrode comprising a redox species insensitive to the analyte), a counter electrode and a reference electrode – that is not described, taught or suggested by either of the Wang and Wrighton references, whether considered individually or in combination.

Applicants respectfully submit that the Wrighton and Wang references when considered in combination do not teach or suggest all of the features of new independent claims 52 and 90. Furthermore, Applicants respectfully submit that no motivation to combine the two references exists as the two references describe completely different and innaposite electrochemical techniques and the Wrighton reference expressly teaches a two electrode system that has the advantage of not requiring a reference electrode whereas the technique and technology of the Wang reference requires a reference electrode. Moreover, if the two systems described in the reference were combined, the resulting and most likely inoperable electrochemical sensor would involve a combination of redox interactions with an analyte between a working and counter electrode and either stripping or biocatalytic interactions between a three electrode system that includes a reference electrode. Applicants respectfully submit that such a sensor would produce a range of unrelated and indecipherable current peaks.

Consequently, Applicants respectfully request that the Section 103 rejections with respect to the new independent claims be withdrawn.

CONCLUSION

In view of the foregoing, it is submitted that the references of record do not anticipate or render obvious Applicants' invention, as recited in each of claims 52-91. The applied references of record has been discussed and distinguished, while significant claimed features of the present invention have been pointed out.

Further, any amendments to the claims which have been made in this response and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto.

Accordingly, reconsideration of the outstanding Office Action and allowance of the present application and all the claims therein are respectfully requested and now believed to be appropriate.

Should the Examiner have any questions or comments, he is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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